Low Cost Method of Manufacturing Cooled Axisymmetric Scramjets, Phase I

Completed Technology Project (2009 - 2009)

Project Introduction

Scramjet engine developers are working on advanced axisymmetric engine concepts that may not be feasible due to limitations of currently available manufacturing methods. The primary goal of this SBIR is to make available a new technology that will make it feasible to manufacture small diameter one-piece cooled axisymmetric scramjet combustors. The availability of the proposed technology will result in scramjet program cost savings and engine design improvements and a strong near term technology commercialization is likely. In fact, scramjet developers have expressed that there is no other known means of manufacturing some of the most desired axisymmetric combustor designs. Although Ormond, LLC currently manufactures scramjet engine panels using a novel abrasivejet machining process and software that is available nowhere else in industry, new engine developments have created the need for key technology advancements. A principal advantage of the proposed technology is that it can generate small high-aspect-ratio channels in nearly any material, and is now used to machine the complex cooling flow field patterns found in the Inconel scramjet heat exchanger circuits. There are technical and economic benefits over all of the existing manufacturing methods because it is a cold, non-chemical low-mechanical load process that has no affect on workpiece material crystal structure. Developments that will be made under this SBIR are: 1.) miniaturization of the specialized cutting head to fit in the axisymmetric combustor, 2.) development of a new numerical model and software needed to implement the process, and 3.) development of an appropriate long reach manipulator arm and control software to provide appropriate tool motion in the combustor cylinder. The Phase I program will initiate the development and demonstrate feasibility of the proposed technology.

Anticipated Benefits

Potential NASA Commercial Applications: Ground based turbine engine transition ducts are consumable high-temperature heat exchangers used in power generating gas turbines. Currently, over 90% of electric power in the world is produced using gas turbines. In one Westinghouse design, 16 transition duct pairs are used per turbine. ABMACH reduces the manufacturing cost by nearly 70%, resulting in $10M in savings per year. Ormond is currently working under funding by ground turbine manufacturers to evaluate implementing ABMACH in the manufacture of these components. Ormond is currently working with a major down-hole energy company to develop tooling with internal features machined into integral cases. The development of the proposed technology will support this proprietary effort directly by making available a means of machining features in tubular components made from tough materials.

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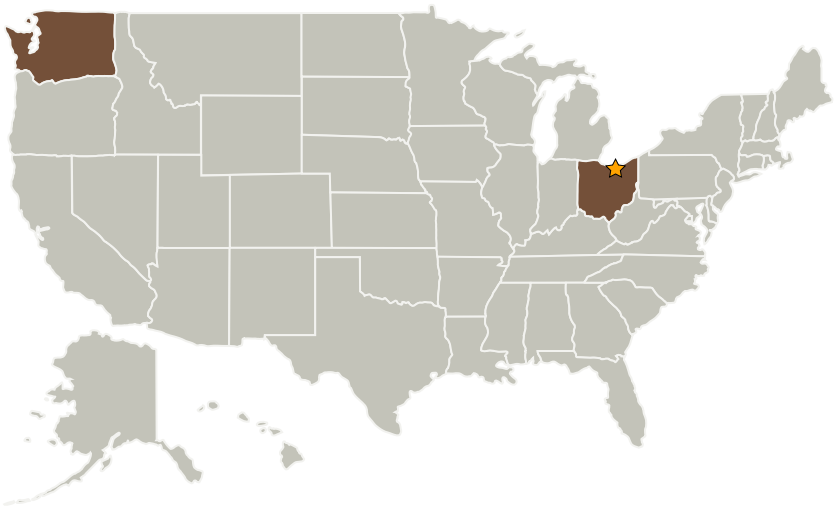
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Glenn Research Center(GRC)	Lead Organization	NASA Center	Cleveland, Ohio
Ormond, LLC	Supporting Organization	Industry	Auburn, Washington

Primary U.S. Work Locations	
Ohio	Washington

Project Transitions

January 2009: Project Start

July 2009: Closed out

Closeout Summary: Low Cost Method of Manufacturing Cooled Axisymmetric S cramjets, Phase I Project Image

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Glenn Research Center (GRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

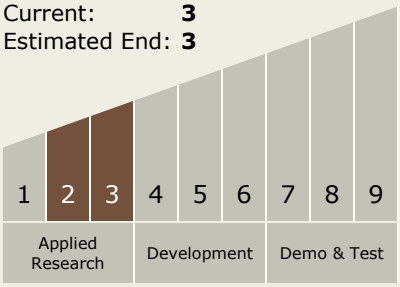
Carlos Torrez

Principal Investigator:

Daniel Alberts

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



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Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.3 Aero Propulsion
    - TX01.3.1 Integrated Systems and Ancillary Technologies